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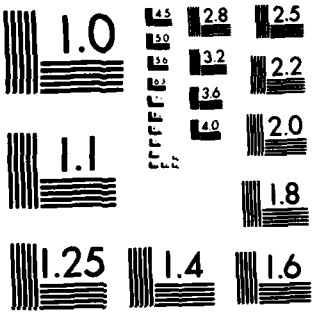

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Crosslinking of computer terminals for nationwide tutorial instruction

Jeffrey A. Schriebman

John E. Swanson

November 1980

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Crosslinking of computer terminals for nationwide tutorial instruction

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Manuscript date: November 1980

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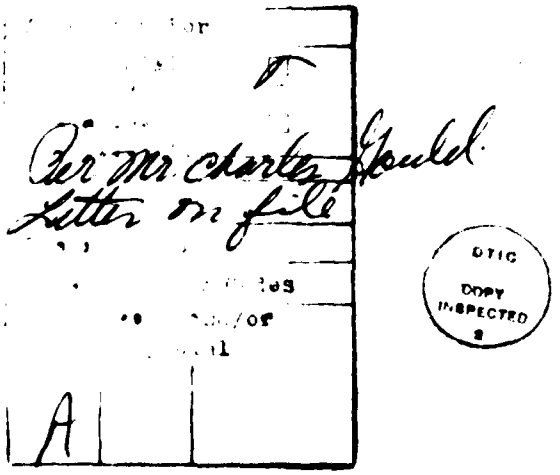
FOREWORD

The Transportation Systems Research Group[1,2] at the Lawrence Livermore National Laboratory (LLNL) is working under contract W-7405-Eng-48 from the U.S. Department of Energy's Office of Advanced Conservation Technologies (DOE/ACT), formerly the Division of Energy Storage Systems (DOE/STOR), to establish a nationwide technology information system in support of ongoing programmatic research and development programs.[3]

This DOE/ACT Technology Information System (TIS) supports the work of program administrators and project leaders by offering information management, interactive modeling, electronic communications, and automated access to a growing number of other information centers. The system is self-guided and contains lookup capabilities for programmatic, administrative, econometric, and engineering and scientific data.

The TIS is currently installed on a PDP 11/70 computer at LLNL with UNIX[4,5] as the operating system and INGRES[6] as the underlying relational data-base management system. However, INGRES (and other subservient programs and models) is invisible to the users, who interact with the system through a high-level, self-prompting user interface. Design and implementation of this interface was based on the LLNL META-MACHINE concept[7-9] for information management. The TIS is accessible by telephone from remote terminals and by use of the ARPANET.[10,11]

This report is part of a series documenting software development in the field of information science for TIS.[12] As the software-user community expands, the importance of training users at remote locations and of demonstrating new features becomes increasingly apparent. The link command described in this report serves these functions by permitting nationwide tutorials to be given.



Viktor E. Hampel
Technology Information System
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CROSSLINKING OF COMPUTER TERMINALS FOR NATIONWIDE TUTORIAL INSTRUCTION

ABSTRACT

This paper describes a procedure for the linking of two or more terminals for demonstrating the use of new software to researchers at distant locations. This linking procedure, which can be used for either real-time tutorials or a classroom-type of instruction, has proven invaluable in actual use and has been implemented on a UNIX[4] V-6 operating system at the Lawrence Livermore National Laboratory. The procedure was developed under the auspices of the Department of Energy's Office of Advanced Conservation Technologies (formerly the Division of Energy Storage Systems).

INTRODUCTION

Trained and knowledgeable people comprise the most valuable resource of any research and development project. All too frequently, however, the means by which people are taught new skills or techniques are inadequate to the task. This inadequacy becomes acutely obvious when attempts are made to explain, for example, rapidly developing, intricate software features over the telephone. To help overcome this problem, we have established a technique that permits the linking of two terminals in such a way that a teacher-student relationship is created.

The teacher-student relationship allows participants to rapidly demonstrate and solve problems. The teacher works in the student's account; both users can enter commands, jointly or separately; and both see the resultant responses. This procedure has proven to be an effective instructional tool, especially when used in combination with voice communication.

DESCRIPTION

Figure 1 shows the way terminals are normally connected to user processes in the UNIX V-6 operating system. In the UNIX environment, input from terminal 1

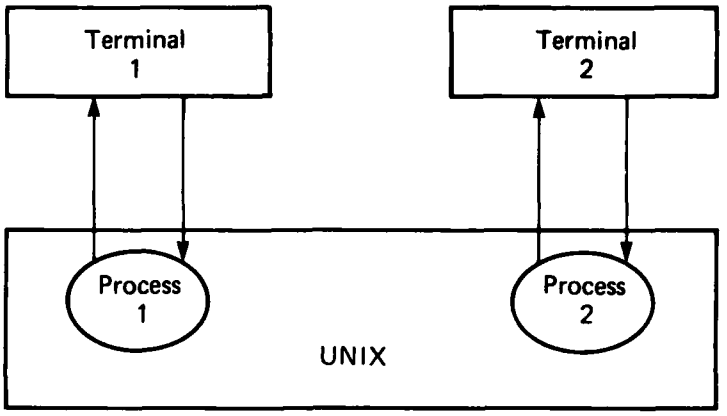

FIG. 1. Terminal-process connection before terminals are linked.

goes directly to the process to which it is connected, in this case process 1, and output from process 1 goes directly to the terminal to which it is connected, in this case terminal 1. Terminal 2 is connected in a similar manner to process 2.

Figure 2 shows the way the two terminals and two processes are connected after these terminals have been linked together. Notice that all of the input from both terminals 1 and 2 goes to process 2 and that the output from process 2 goes to both terminals 1 and 2; the output from process 1 continues to go to terminal 1. In the arrangement shown in Fig. 2, the user at terminal 1 is the teacher, and the user at terminal 2 is the student.

Establishment of a terminal-to-terminal link requires the cooperation of both users. Initial user-to-user interaction by telephone or by UNIX system commands (e.g., "write"[5]) defines the respective roles of teacher and student. As a rule, the student's role would be assumed by the person whose account contains the files and programs in question. The simple example below shows how the cooperative link is established:

- User John, who is going to be the student, types: "link jeff s".
- User Jeff, who is going to be the teacher, types: "link john t".

This procedure announces the mutual readiness of both parties and creates a link from Jeff's terminal to John's terminal. Both terminals become equivalent with respect to input and output. John may now give a command and Jeff can correct it while it is being typed; explanations can be given by phone. When the tutorial is concluded, the character EOF (CTRL-D), entered by either user, terminates the link.

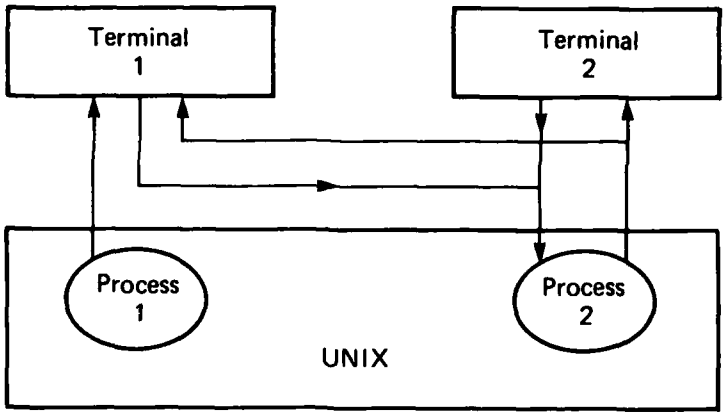

FIG. 2. Terminal-process connection after terminals are linked.

ADDITIONAL FEATURES

Additional terminals can be slaved from the original teacher-student link to create a classroom environment. These additional terminals are linked as monitors and are not connected to the student process for input, as is the teacher's terminal. Thus, while the members of the class can view and hear the teacher-student instruction (e.g., by a voice-telephone conference connection) and can voice their comments, they cannot interfere with the instructions. The students' monitor terminals remain connected to their own standard UNIX processes.

A complete audit file of the tutorial session can be established by the student. This file permits the printing of a full transcript of the session should either the teacher or the student have been working initially with a CRT terminal or should the student wish to retain a record for subsequent examination by someone else. The audit file is created by specifying a third argument to the link command by the user, who specifies the "s" option. In the above example, John could have created an audit file named "audit" if he had typed:

- "link jeff s audit".

If desired, a single-character terminal identifier may be used in place of the user name to establish the proper connection.

SOFTWARE AVAILABILITY

For information regarding the availability of this UNIX V-6 software modification, please contact:

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CONCLUSIONS

The tutorial method developed by the Lawrence Livermore National Laboratory has been successfully used for about two years. This procedure, which can be used nationwide in either an impromptu mode or a scheduled tutorial mode, has proved to be a valuable tool for demonstrating system capabilities and for instructing software users.

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